

This is in response to the Amendment dated August 3, 2011. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office Action.

### ***Response to Arguments***

#### Election/Restrictions

Claims **3-11, 18-19, 21 and 23-24** directed to species of the process for sequestering carbon in the atmosphere, previously withdrawn from consideration as a result of a restriction requirement, are hereby rejoined and fully examined for patentability.

Newly submitted claims **28 and 29** are directed to an invention that is independent or distinct from the invention originally claimed for the following reasons:

Original claim 1, lines 4-5, recited:

“a step for electro-reduction in an aprotic medium to a compound in which the carbon changes to oxidation number +3 in the form of oxalic acid or formic acid,”

New claim 28, lines 3-5, recite:

“a step for electro-reduction resultant liquid phase containing concentrated CO<sub>2</sub> or carbonic acid in an aqueous medium to formic acid or formate in which the carbon changes to oxidation number +3.”

Original claim 1 was not a generic claim and the electro-reduction in an aprotic medium is not the same as the electro-reduction in an aqueous medium. New claim 28 recites a limitation that was not previously examined in any original or previously

amended claim.

Since applicant has received an action on the merits for the originally presented invention (Abbott et al. teach that HFC 134a is aprotic ~ page 776, left column, lines 49-50), this invention has been constructively elected by original presentation for prosecution on the merits. Accordingly, claims **28 and 29** are withdrawn from consideration as being directed to a non-elected invention. See 37 CFR 1.142(b) and MPEP § 821.03.

This application contains claims **28 and 29** drawn to an invention nonelected. A complete reply to the final rejection must include cancellation of nonelected claims or other appropriate action (37 CFR 1.144) See MPEP § 821.01.

#### Claim Objections

Claim **1** has been objected to because of minor informalities.

The objection of claim **1** has been withdrawn in view of Applicants' amendment.

#### Claim Rejections - 35 USC § 112

I. Claims **1-2, 12-17, 20, 22 and 25-27** have been rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

The rejection of claims **1-2, 12-17, 20, 22 and 25-27** under 35 U.S.C. 112, second paragraph, has been withdrawn in view of Applicants' amendment.

**II.** Claims **1-2, 12-17, 20, 22 and 25-27** have been rejected under 35 U.S.C. 112, second paragraph, as being incomplete for omitting essential structural cooperative relationships of elements, such omission amounting to a gap between the necessary structural connections. See MPEP § 2172.01. The omitted structural cooperative relationships are: between steps (a) and (b)-(d).

The rejection of claims 1-2, 12-17, 20, 22 and 25-27 under 35 U.S.C. 112, second paragraph, has been withdrawn in view of Applicants' amendment.

**III.** Claims **1-2, 12-17, 20, 22 and 25-27** have been rejected under 35 U.S.C. 112, second paragraph, as being incomplete for omitting essential structural cooperative relationships of elements, such omission amounting to a gap between the necessary structural connections. See MPEP § 2172.01. The omitted structural cooperative relationships are: between the carbon emitted into the atmosphere and a compound in which the carbon changes to oxidation number +3.

The rejection of claims 1-2, 12-17, 20, 22 and 25-27 under 35 U.S.C. 112, second paragraph, has been withdrawn in view of Applicants' amendment.

**IV.** Claims **1-2, 12-17, 20, 22 and 25-27** have been rejected under 35 U.S.C. 112, second paragraph, as being incomplete for omitting essential structural cooperative relationships of elements, such omission amounting to a gap between the necessary structural connections. See MPEP § 2172.01. The omitted structural cooperative

relationships are: between the compound and the oxalic acid or formic acid.

The rejection of claims 1-2, 12-17, 20, 22 and 25-27 under 35 U.S.C. 112, second paragraph, has been withdrawn in view of Applicants' amendment.

**V.** Claims **15 and 25-27** have been rejected under 35 U.S.C. 112, second paragraph, as being incomplete for omitting essential structural cooperative relationships of elements, such omission amounting to a gap between the necessary structural connections. See MPEP § 2172.01. The omitted structural cooperative relationships are: between the liquid CO<sub>2</sub> under pressure and the concentrated CO<sub>2</sub> in the liquid phase.

The rejection of claims 15 and 25-27 under 35 U.S.C. 112, second paragraph, has been withdrawn in view of Applicants' amendment.

**VI.** Claim **17** has been rejected under 35 U.S.C. 112, second paragraph, as being incomplete for omitting essential structural cooperative relationships of elements, such omission amounting to a gap between the necessary structural connections. See MPEP § 2172.01. The omitted structural cooperative relationships are: between the non-aqueous medium and the aprotic medium.

The rejection of claim 17 under 35 U.S.C. 112, second paragraph, has been withdrawn in view of Applicants' amendment.

Claim Rejections - 35 USC § 103

I. Claims **1-2, 12-16, 22 and 25** have been rejected under 35 U.S.C. 103(a) as being unpatentable over **Abbott et al.** ("Electrochemical Reduction of CO<sub>2</sub> in a Mixed Supercritical Fluid", *J. Phys. Chem B* (2000), Vol. 104, pp. 775-779) in view of **CS 111531** ('531).

The rejection of claims 1-2, 12-16, 22 and 25 under 35 U.S.C. 103(a) as being unpatentable over Abbott et al. in view of CS 111531 ('531) has been withdrawn in view of Applicants' amendment.

II. Claim **17** is rejected under 35 U.S.C. 103(a) as being unpatentable over **Abbott et al.** ("Electrochemical Reduction of CO<sub>2</sub> in a Mixed Supercritical Fluid", *J. Phys. Chem B* (2000), Vol. 104, pp. 775-779) in view of **CS 111531** ('531) as applied to claims 1-2, 12-16, 22 and 25 above, and further in view of **Baniel et al.** (US Patent No. 4,275,234).

The rejection of claim 17 under 35 U.S.C. 103(a) as being unpatentable over Abbott et al. in view of CS 111531 ('531) as applied to claims 1-2, 12-16, 22 and 25 above, and further in view of Baniel et al. has been withdrawn in view of Applicants' amendment.

***Response to Amendment***

***Claim Rejections - 35 USC § 112***

I. Claims **1-27** are rejected under 35 U.S.C. 112, second paragraph, as being

indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 1

line 4, it appears that the "concentrated CO<sub>2</sub>" is the same as the concentrating CO<sub>2</sub> recited in claim 1, line 3. However, the claim language is unclear as to whether it is. The subsequent mention of an element is to be modified by the definite article "the", "said" or "the said," thereby making the latter mention(s) of the element unequivocally referable to its earlier recitation.

Claim 9

lines 1-2, "the solution obtained" lacks antecedent basis.

Claim 16

line 1, "the compound" lacks antecedent basis.

Claim 17

line 2, it appears that "an aprotic medium" is the same as the aprotic medium recited in claim 1, line 5. However, the claim language is unclear as to whether it is. The subsequent mention of an element is to be modified by the definite article "the", "said" or "the said," thereby making the latter mention(s) of the element unequivocally referable to its earlier recitation.

Claim 20

lines 2-3, recite "an aqueous solution of oxalic acid or formic acid from electro-reduction step (b)."

Claim 1, lines 4-6, recite "b) a step for electro-reduction of resultant liquid phase containing concentrated CO<sub>2</sub> or carbonic acid in an aprotic medium to oxalic acid or formic acid in which the carbon changes to oxidation number +3."

It is unclear from the claim language how an aqueous solution of oxalic acid or formic acid results from the electro-reduction step (b) when the electro-reduction step (b) is carried out in an aprotic medium. However, there is an aqueous phase of oxalic acid or formic acid recited in the extracting step (c) [claim 1, lines 8-9].

Claim 21

line 1, "said carbonated mineral" lacks antecedent basis. Note that claim 1, lines 11, recites "producing a mineral".

Claim 23

lines 1-4, recite:

A process according to claim 1, in which the mineralization step comprises bringing an aqueous solution of oxalic acid or formic acid derived from the electro-reduction step into contact with a calciferous or magnesia-containing sedimentary rock.

Claim 1, lines 4-6, recite "b) a step for electro-reduction of resultant liquid phase containing concentrated CO<sub>2</sub> or carbonic acid in an aprotic medium to oxalic acid or formic acid in which the carbon changes to oxidation number +3."

It is unclear from the claim language how an aqueous solution of oxalic acid or

formic acid is derived from the electro-reduction step (b) when the electro-reduction step (b) is carried out in an aprotic medium. However, there is an aqueous phase of oxalic acid or formic acid recited in the extracting step (c) [claim 1, lines 8-9].

Claim 26

lines 1-3, recite "an aqueous solution of oxalic acid or formic acid derived from electro-reduction step (b)."

Claim 1, lines 4-6, recite "b) a step for electro-reduction of resultant liquid phase containing concentrated CO<sub>2</sub> or carbonic acid in an aprotic medium to oxalic acid or formic acid in which the carbon changes to oxidation number +3."

It is unclear from the claim language how an aqueous solution of oxalic acid or formic acid is derived from the electro-reduction step (b) when the electro-reduction step (b) is carried out in an aprotic medium. However, there is an aqueous phase of oxalic acid or formic acid recited in the extracting step (c) [claim 1, lines 8-9].

II. Claims 1-27 are rejected under 35 U.S.C. 112, second paragraph, as being incomplete for omitting essential structural cooperative relationships of elements, such omission amounting to a gap between the necessary structural connections. See MPEP § 2172.01. The omitted structural cooperative relationships are: between steps (a) and (b).

Claim 1

lines 1-13, recite:



A process for sequestering carbon in the atmosphere, comprising:

- a) a step for concentrating  $\text{CO}_2$  in a liquid phase;
- b) a step for electro-reduction of resultant liquid phase containing concentrated  $\text{CO}_2$  or carbonic acid in an aprotic medium to oxalic acid or formic acid in which the carbon changes to oxidation number +3;
- c) if appropriate, a step for extracting said oxalic acid or formic acid in an aqueous phase; and
- d) a step for mineralization by reacting said oxalic acid or formic acid with a compound carbonate of an element M, producing a mineral in which the atomic ratio C/M is about 2/1, wherein M is any metallic element with an oxidation number of +2, and C is carbon, and wherein the oxalic acid and formic acid are in an acid or salt form.

The resultant liquid phase containing concentrated  $\text{CO}_2$  or carbonic acid recited in the electro-reduction step (b) that is to be modified is not the subsequent mention of an element that is earlier recited. Thus, there is no relationship between steps (a) and (b).

### ***Allowable Subject Matter***

The following is a statement of reasons for the indication of allowable subject matter:

Claims 1-27 define over the prior art of record because the prior art does not teach or suggest a process for sequestering carbon in the atmosphere comprising the steps of (a) concentrating, (b) electro-reduction, (c) if appropriate, extracting and (d) mineralization as presently claimed, esp., the step for mineralization by reacting said oxalic acid or formic acid with a carbonate of an element M, producing a mineral in which the atomic ratio C/M is about 2/1, wherein M is any metallic element with an oxidation number of +2, and C is carbon, and wherein the oxalic acid and formic acid

are in an acid or salt form. The prior art does not contain any language that teaches or suggests the above.

*Abbott et al.* do not teach a step for mineralization by reacting oxalic acid or formic acid with a carbonate of an element M, producing a mineral in which the atomic ratio C/M is about 2/1, wherein M is any metallic element with an oxidation number of +2, and C is carbon, and wherein the oxalic acid and formic acid are in an acid or salt form.

CS 111531 does not teach reacting oxalic acid or formic acid with a carbonate of an element M.

Therefore, a person skilled in the art would not have been motivated to adopt the above conditions, and a *prima facie* case of obviousness cannot be established.

Claims 1-27 would be allowable if rewritten or amended to overcome the rejection(s) under 35 U.S.C. 112, 2nd paragraph, set forth in this Office action.

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the

shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to EDNA WONG whose telephone number is (571)272-1349. The examiner can normally be reached on Mon-Fri 7:30 am to 4:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jeffrey T. Barton can be reached on (571) 272-1307. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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